ERIC Documents Resume	See Instruction Sheet	DATE OF RESUME 9/18/65	DATE RECEIVED

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.	DO NOT WRITE IN SPACE BELOW
ED001903	N.A.	N.A.	

4. AUTHOR(S): Houston Independent School District

5. TITLE OF DOCUMENT ABSTRACTED: Course Outline for Science Talent Preservation Classes

6. PUBLICATION TITLE: N.A.

7. EDITOR(S): N.A.

8. PLACE OF ORIGIN: Houston Independent
ORG. School District
ST. Houston, Texas
CITY, STATE

9. PUBLISHER OR SOURCE: Houston Independent School District
Houston, Texas

10. VOL.	11. PAGES	12. MO./YR.	13. TOTAL PP.
N.A.	N.A.	10/ 1964	48

TELE. EXT.
INST/LOC CODE

MICROFILM COPY AVAILABLE: YES ☒ NO ☐

COPYRIGHT GRANTED: YES ☐ NO ☒

COPYRIGHT RELEASE FILED: YES ☐ NO ☐

TYPE OF REPORT: PROPOSAL ☐ IN-PROGRESS ☒ FINAL ☐ FOLLOW-UP ☐

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR: Course Outline

16. INDEXING TERMS (6-12)

science
teaching methods
audiovisual material
Houston Independent School District
Houston, Texas
Talent Preservation

17. ABSTRACT (MAX. 250 WORDS)

Each unit is of approximately six weeks' duration. Units are on energy and the human body, heat, electricity and machines, consumer science from a communication and physical science approach, and consumer science from a biological and earth approach.

In all units, as many concepts as possible should be related to the students' experiences. In particular, basic principles of chemistry should be learned through concrete experiences, with a minimum attempt to explore mathematical phases. A question method is used frequently with discussion and experimentation to seek answers.

Each unit consists of textbook references, a step-by-step outline with accompanying teaching suggestions, and lists of reference and audiovisual materials.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

19. SUPPORTING ORGANIZATION	20. DIVISION OR DEPT.	21. CONTRACT NO. / PROJECT NO.
	22. TOTAL COST OF PROJECT	
	23. DURATION OF PROJECT	U.S. Department of Health, Education, and Welfare Office of Education

ED001903

COURSE OUTLINE

for

SECOND SIX WEEKS

of

SCIENCE - LEVEL III

TALENT PRESERVATION CLASSES

REPRINTED BY PERMISSION
U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN PRINTED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

Houston Independent School District

Houston, Texas

October 1964

LEVEL THREE

UNIT II: ENERGY AND THE HUMAN BODY (Approximately six weeks)

TOPIC 1: SOUND

Textbook References

Physical Science, pp. 492-505; expanded reading pp. 506-528.

Science 3, pp. 259-278; expanded reading, pp. 317-338.

. . . . . .

Content

A. How sounds are produced
   1. By vibrating objects
   2. By explosions and implosions

B. Characteristics of sound
   1. Speed of sound
   2. Wave motion
      a. Transverse
      b. Longitudinal
         (1) Compression
         (2) Rarefaction
   3. Wave length
   4. Frequency (pitch)
   5. Amplitude

C. Kinds of sound
   1. Sonic
      a. Noise
      b. Music
   2. Supersonic

D. Transmission of sound
   1. By molecular movement
   2. By states of matter
   3. By special devices
      a. Stethoscope
      b. Hearing aids
      c. Human ear

Suggestions

Relate the study of sound to the students' own personal experience, and make sure that demonstrations and laboratory experiments, as well as class discussions, show the relationship of sound to the human senses. Approach the concepts of sound through the student's understanding of his own hearing devices—how they work, and how they function in interaction with his physical environment. If the students are motivated to the point that they want to explore the expanded readings concerning electronic audio devices, they may do so, but keep in mind that such topics will be covered in detail in a later unit.

Make effective use of a tape recorder and let each student hear his own voice. If the recorder is operated during a class discussion without the students' knowledge, a more candid recording will be obtained.

Compare the range of audible frequencies for man with those for other animals.

Discuss how the human nervous system reacts to certain musical phenomena, such as musical instruments and dancing.

Guide study and learning activities with such questions as:

1. What is the difference between noise and music?
2. What happens to radio and television sounds whenever the volume is altered?

E. The human ear
   1. Outer ear
   2. Middle ear
   3. Inner ear

F. Music
   1. Octave (Eight test tubes)
   2. Timbre
   3. Chords
   4. Resonance and interference
   5. Musical instruments
      a. Percussion
      b. String
      c. Wind
         (1) Brass wind
         (2) Wood wind
         (3) Pipe organ
         (4) Human voice

3. What is the function of each bone in the middle ear?
4. How does a violin produce sound? What factors determine its quality? Its volume?
5. Why are acoustics important? What makes a good acoustic material?
6. Why will sound not travel through a vacuum?
7. How do the vocal cords produce sound?
8. What does a band leader do?
9. Why must ears be kept clean? Why should they be protected?
10. What happens when airplanes break through the sound barrier? What is a sonic boom?
11. Why do we see lightning before we hear the thunder?

Reference Readings

Cosgrove, Margaret. The Strange World of Animal Senses. Dodd, 1961.

Mason, G. F. Animal Sounds. Morrow, 1948.

Mathews, F. S. Field Book of Wild Birds and Their Music. Putnam, 1921.

Schneider, Lee. You and Your Senses. Harcourt, 1956.

Zim, H. S. Our Senses and How They Work. Morrow, 1956.

Adler, Irving. Energy and Power. Knopf, 1958.

Baer, M. E. Sound: An Experiment Book. Holiday, 1952.

Beeler, N. F. Experiments in Sound. Crowell, 1961.

Feravolo, Rocco. Wonders of Sound. Dodd, 1962.

Freeman, I. M. All About Sound and Ultrasonics. Random House, 1961.

Kettelkamp, Larry. Magic of Sound. Morrow, 1956.

Knight, D. C. The First Book of Sound: A Basic Guide to the Science of Acoustics. Watts, 1960.

Parker, B. M. Sound. Row, 1955.

Van Bergisjk, W. A. Waves and the Ear. Doubleday, 1959.

Audio-Visual Materials

Films

L 1908	The Alphabet Conspiracy: Part I	C 30 min.
L 1909	The Alphabet Conspiracy: Part II	C 30 min.
1858	Fundamentals of Acoustics	11 min.
65	Sound Waves and Their Sources	11 min.
M 2303	Vibrations	C 14 min.
1458	The Ears and Hearing	11 min.
2003	You and Your Ears	C 8 min.
471	Your Voice	11 min.
1328	Your Ears	10 min.
2300	Waves and Energy	11 min.

Filmstrips

FsG-2133 Sound: Series 7

FsG-2144 Sound: Series 8

Fs-1357 The Ears

Fs-1944 You and Your Ears

Transparencies

Tr-1013 Structure of the Human Ear

Consult the latest Audio-Visual Materials Catalog for descriptions and other listings.

TOPIC 2: LIGHT

Textbook References

Physical Science, pp. 448-489; expanded reading, pp. 521-526.

Science 3, pp. 229-256; expanded reading, pp. 333-335, 200-210.

. . . . . .

Content

A. Facts about light
   1. Form of radiant energy
   2. Speed—186,000 miles/sec.
   3. Travels in straight line
      a. Shadows
      b. Eclipses

B. Sources of light—luminous objects
   1. The sun (and other stars)
   2. Light bulbs
   3. Fire

C. Illumination
   1. The moon and the planets
   2. Visibility of one's physical environment—objects

D. Reflection
   1. Incident rays
   2. Reflected rays
   3. Importance of dust particles in the air

E. Refraction
   1. Incident rays
   2. Refracted rays
   3. Refraction experiment (Refer to Science 3, p. 238.)

Suggestions

In the study of light, stress the difference between luminous and illuminated objects.

Compare the ways in which light and heat vary—in such matters as speed and absorption—as they pass through different mediums.

Discuss the fact that luminous objects involve energy transformations, such as:

1. Light bulbs—electrical energy to heat energy and light energy
2. Fire—chemical energy to heat energy and light energy

Employ demonstrations and experiments to promote the following understandings:

1. Incident and reflected rays are equal in their angular variation from a perpendicular to the point of incidence on the reflecting surface.
2. The intensities of the incident and reflected rays will differ according to the nature of the reflecting surface.
3. Because of the refraction of light rays, underwater objects, such as fish and stones, may not be where they appear to be, simply because the human eye fails to take the bending of light rays into consideration; that is, they tend to associate the object with an imaginary straight line of continuance rather than the true refracted path of light.

F. Terms

1. Transparent
2. Translucent
3. Opaque
4. Diffusion

G. Lenses

1. Convex lens (magnifying glass)
2. Concave lens (reducing glass)
3. Terms

a. Object
b. Real image
c. Virtual image
d. Focal point
e. Focal length
f. Converge (convex lens)
g. Diverge (concave lens)
h. Inverted (convex lens)
i. Erect (concave lens)

H. Optical devices

1. Telescope
2. Microscope
3. Camera

I. The human eye

1. Structures

a. Cornea
b. Pupil and iris diaphram
c. Lens
d. Retina
e. Fluids—aqueous and vitreous
f. Optic nerve

2. Farsightedness
3. Nearsightedness
4. Other eye defects—cataracts

J. Lighting the home

1. Candlepower(at source)
2. Intensity (varies inversely with distance from source)
4. Optical devices depend on the fact that light rays can be reflected or refracted.
5. In passing from one substance into another, light rays always bend toward the denser substance.
6. Color is a property of light.
7. Pigments absorb all colors except the one (ones) reflected to the eye.
8. Rainbows exist because the different colors vary in refractivity—greater for violet, less for red.

Guide study projects and discussions with such questions as:

1. What are primary pigments and colors? In what ways are they important to man?
2. Why does a diamond sparkle?
3. What causes a rainbow?
4. How can one prove that color is a property of light?
5. Is black a color? How does one account for an object being black?
6. How do glasses correct for far and near sightedness?
7. What is the function of the retina?
8. Why do cameras have lenses?
9. Why do doctors check the pupils of the eyes when they examine an unconscious person?
10. What is the explanation for virtual images? What are some ways in which man uses them?
11. Why does light intensity vary inversely with the distance from the source? How does this compare to gravity? Magnetism?
12. Which methods of lighting are used in my home? How could my home lighting situation be improved?

3. Methods of lighting
   a. Direct lighting
   b. Indirect lighting
   c. Semi-direct lighting
4. Kinds of light sources
   a. Chemical—fire
   b. Electrical
      (1) Incandescent lamps
      (2) Fluorescent lamps
      (3) Neon tubes
      (4) Sodium vapor lamps

K. Importance of good vision
   1. Need for early correction
   2. Need for good habits
      a. In use of glasses when prescribed
      b. Avoiding glare—sunlight
      c. Shading eyes or sunglasses
      d. Frequent check-ups

L. Light for safety
   1. Laws concerning traffic and automobiles
   2. Around the house
   3. Aircraft and beacons

M. The electric eye

N. Light for communication
   1. Flashing code (as between ships)
   2. Distress signals (mirrors and fires)

13. Which method of lighting is best for reading?

14. Which is the cheapest light source? Why?

15. Where are neon tubes used? Why?

16. What are five chemical sources of light that were used by man before the discovery of electricity? When are they used today?

17. Who developed the first incandescent lamp?

18. How does a light meter work? Where is it used?

19. Why is the sun easier to view at sunset than at noon?

20. What are twenty things that you would have to give up if vision became lost?

21. What are the first symptoms of an eye defect?

Emphasize why laws are needed concerning the use of light in automobile traffic, on the automobile itself, and in any other situation where moving objects are involved.

Indicate to the students that this unit covers only two of the forms of energy that affect the human body. Other forms will be covered in later units, including electrical energy, heat energy, chemical energy, and mechanical energy.

Discuss the use of the Morse Code. Using flashlights, have the students practice important signals, such as S.O.S.

Reference Readings

Bragdon, Lillian J. Let There Be Light. Lippincott, 1959.

Sutton, Vane S. The Story of Eyes. Viking, 1958.

Branley, F. M. Solar Energy. Crowell, 1957.

Moore, Patrick. Telescopes and Observatories. Day, 1962.

Neal, H. E. The Telescope. Messner, 1958.

Wilkins, H. P. How To Make and Use a Telescope. Norton, 1956.

Adler, Irving. Color in Your Life. Day, 1962.

_____. Secret of Light. International Publishers, 1952.

Beeler, N. F. Experiments with Light. Crowell, 1958.

Jaffe, Bernard. Michelson and the Speed of Light. Doubleday, 1959.

Jupe, F. J. Adventure in Light. Prentice, 1958.

Leyson, B. W. The Miracle of Light and Power. Dutton, 1955.

Meyer, J. S. Prisms and Lenses. World, 1959.

Parker, B. M. Light. Row, 1956.

Rogers, Frances. Lens Magic. Lippincott, 1957.

Ruchlis, Hyman. The Wonder of Light. Harper, 1960.

Guthridge, Sue. Tom Edison, Boy Inventor. Bobbs, 1947.

Meadowcroft, W. H. Boy's Life of Edison. Harper, 1921.

Weir, R. C. Thomas Alva Edison, Inventor. Abingdon, 1953.

Audio-Visual Materials

Films

1717	Story of Light	C 10 min.
293	How Man Made Day	11 min.
M 2305	How To Bend Light	C 12 min.
1451	Light and Shadow	11 min.
1514	Nature of Color	C 10 min.
1433	Seeing Is Believing	10 min.
M 1468	The Speed of Light	14 min.
1902	The Story of Motion Pictures	6 min.
387	Your Eyes	11 min.
1721	Thomas Alva Edison	8 min.
L 2311	Measuring Long Distances	29 min.

Films, contd.

1159	Day and Night	9 min.
2299	Energy and Its Forms	C 11 min.

Filmstrips

FsG-2132	Light: Series 7
FsG-2143	Light: Series 8
Fs-1358	The Eyes
Fs- 701	Eyes and Their Care
Fs-2189	Helping People To See
Fs-1043	You and Your Eyes

Transparencies

Tr-1001	Behavior of Light
Tr-1012	Structure of the Human Eye

Tapes

T97	Conquerors of Sight, Sound, and Space—Forerunners of Television—15 min.
T77	The Eclipse—15 min.
T99	Thomas Alva Edison, The Wizard of Menlo Park—15 min.

COURSE OUTLINE

for

THIRD SIX WEEKS

of

SCIENCE - LEVEL III

TALENT PRESERVATION CLASSES

Houston Independent School District

Houston, Texas

December, 1964

LEVEL THREE

UNIT III: HEAT (Approximately six weeks)

TOPIC 1: FIRE AND FUELS

Textbook References

Physical Science, pages 232-244, 245-266; expanded reading, pages 267-286.

Science 3, pages 71-88; expanded reading, pages 65-71, 3-28.

.....

Content	Suggestions
A. What is heat? B. Energies that transform into heat 1. Electrical 2. Mechanical (friction) 3. Chemical C. Conditions necessary for burning D. Kindling temperature E. Oxidation 1. Rapid oxidation a. Complete combustion b. Incomplete combustion 2. Slow oxidation a. Oxides of: (1) Iron (rust) (2) Aluminum (3) Zinc b. Respiration F. Change of matter 1. Physical change 2. Chemical change G. Spontaneous combustion H. Methods of extinguishing a fire 1. Water—reduces the temperature of the fuel to below the kindling point. 2. Carbon dioxide—keeps oxygen away from the fuel.	Although most Talent Preservation students will not be able to explore deeply into the mathematical phases of chemistry, they should acquire some understanding of the basic principles of heat and energy, and how matter changes. The content of this topic (Fire and Fuels) should be accompanied by many concrete experiences—through demonstration and experimentation—that will illustrate these basic concepts of chemistry. Pupil projects and laboratory work should seek to develop such understandings as the following: Exothermic reactions—whenever two or more substances combine chemically, at least two things happen: A chemical change takes place. Heat, and sometimes light and mechanical energy, are produced. Endothermic reactions—whenever the constituents of a compound become disunited (decomposition), at least two things happen: A chemical change takes place. Heat energy is "absorbed" (taken up). Because oxygen is both plentiful and active, it exists in many compounds. It accounts for about $\frac{1}{2}$ of the earth, by weight, and is active in the sense that it will combine with metals to form ores. Industries rely on sources of heat, such as coal and gas, in order to decompose (by endothermic action) metal ores.

F

3. Acid—does both 1 and 2 on the preceding page

(Note: An effective fire extinguisher removes at least one of the above conditions for burning.)

I. Ways to prevent fires

1. Frequent house cleaning
2. Proper storage of gasoline, oil, and other substances that are readily combustible
3. Developing habits of safety to overcome carelessness
4. Avoiding misuse of electricity
   a. Not overloading circuits
   b. Using proper fuses
   c. Repairing faulty appliances

J. Fuels

1. Natural fuels
   a. Solid—wood, peat, coal
   b. Liquid—petroleum
   c. Gas—natural gas
2. Manufactured fuels
   a. Solid—charcoal, coke
   b. Liquid—gasoline, kerosene, alcohol
   c. Gas—acetylene, coal gas

K. Thermal explosions

L. Forest fires

1. Natural causes
2. Human causes

Such things as burned toast and a burn on the skin are products of endothermic reactions, where heat was added in sufficient quantity to effect decomposition, but in insufficient quantity to develop the kindling temperatures of such substances and thus initiate the phenomenon of fire (exothermic action). Spontaneous combustion occurs when heat produced by slow oxidation is conserved and applied to the decomposition of the fuel and eventually raises the fuel to its kindling temperature. In most cases, however, heat produced by slow oxidation is not conserved.

Matches and pilot lights are used to effect an initial decomposition of the fuel and at the same time raise the temperature of the fuel to its kindling point, after which such functions will be perpetuated by the fire itself (exothermic).

Numerous demonstrations and laboratory experiments, should be planned along with various pupil projects, to implement the above understandings. Following are some suggestions:

Destructive distillation of wood—showing in minutes what nature takes millions of years to do. Here, the product is charcoal; in nature, the product is coal.

Spectacular combustions—such as burning sulfur or steel wool in pure oxygen, burning magnesium in air, and burning yellow phosphorus in air. Point out the chemical changes and products.

Comparing kindling temperatures of phosphorus, sulfur, paper, wood, coal, and magnesium, using a pie tin and a Bunsen burner.

Slow oxidation—using iron filings in an inverted test tube placed in a beaker of water. By noting the rise of the water in the test tube, the students can develop the understanding that air is about one-fifth oxygen.

M. Carbon Dioxide

1. Failure to support combustion
2. Weight in comparison to air
3. Production as a result of:
   a. Combustion
   b. Respiration
4. Photosynthesis
5. Carbon dioxide cycle
6. Carbonic acid (used in carbonated drinks)
7. Dry ice

Burn a candle under a clean inverted beaker to indicate the products of combustion.

Prepare carbon dioxide and pour it over a candle flame. Make the limewater test for CO_2. Compare the splint test for oxygen and the same for CO_2.

To show that plant life respires, place a green plant in a closed bottle that is about $\frac{1}{4}$ full of $Ca(OH)_2$. Allow it to stand overnight in darkness, then observe the film of $CaCO_3$ on surface.

Place dry ice into water. Explain that the "smoke" is not CO_2, but water that has condensed from the air.

Reference Readings

Branley, F. M. Solar Energy. Crowell, 1957.

Vaughn-Jackson, Genevieve. Mountains of Fire (Volcanoes). Hastings, 1962.

Beeler, N. F. Experiments in Chemistry. Crowell, 1952.

Freeman, I. M. All about the Wonders of Chemistry. Random House, 1954.

Gallant, R. A. Exploring Chemistry. Garden City Books, 1958.

Morgan, A. P. First Chemistry Book for Boys and Girls. Scribner, 1950.

Cooper, E. K. Discovering Chemistry. Harcourt, 1959.

Audio-Visual Materials

Films

1453	Friction		11 min.
M1935	Combustion	C	15 min.
224	Fire		10 min.
1851	Fuels—Their Nature and Use		11 min.
384	Our Common Fuels		11 min.
L1122	Birth of an Oil Field	C	30 min.
M1362	Last Ten Feet		20 min.
M1308	Story of Oil		17 min.

Filmstrips

Fs-1232 Oil from Earth to You
Fs-1231 Petroleum in Today's Living
Fs-1419 Natural Gas: Science Behind Your Burner

TOPIC 2: TEMPERATURE AND HEAT

Textbook References

Physical Science, pages 99-147; expanded reading, pages 424-426.

Science 3, pages 91-120; expanded readings, pages 126-142.

.....

Content

A. Sources of heat
   1. The sun
   2. Chemical reactions
   3. Friction
   4. Electricity

B. Temperature
   1. Fahrenheit scale
   2. Expansion and contraction

C. Quantity of heat
   1. Calorie
   2. British thermal unit (B.T.U.)

D. How heat travels
   1. Conduction
   2. Convection
   3. Radiation

E. Absorption of heat
   a. Weather
   b. Soil temperature
   c. Other dark objects

F. Melting and evaporation
   1. Heat of fusion
   2. Heat of vaporization

G. Heating systems
   1. Hot-air furnace
   2. Hot water
   3. Steam

Suggestions

Develop the idea that virtually all of the energy on earth is directly or indirectly derived from the sun. Review those understandings from Level Two Science that involve energy from the sun, such as photosynthesis, weather, and continental water run-off. Involve the students in research projects that seek answers to the following questions:

1. What are the main differences between the Fahrenheit and Centigrade temperature scales?
2. What is the relationship between heat, temperature, and volume? What are some analogies? (e.g., acid, acidity, and volume)
3. What is convection? What does the term "mass transfer current" have to do with heat?
4. What is conduction? What does the term "mass relay of energy" have to do with heat?
5. What is radiation? Why is absorption an important factor in heat radiation?
6. If an eraser were used to represent heat, how would you compare the action of throwing it, passing it from pupil to pupil, and jumping with it, to the movement of real heat?
7. Why does one usually feel cold after coming out of the water?
8. Why is heat of vaporization important in systems of air-conditioning and refrigeration? How is this principle utilized?
9. Why is heat of fusion important in the ice box?

H. Insulation
   1. Thermos bottle
   2. Good insulators
I. Air-conditioning
   1. Removal of heat
   2. Humidity control
J. Heat pumps
K. Refrigeration
L. Procedures for fire safety
   1. Ventilation
   2. Keeping combustibles away
   3. Not overloading electric circuits
   4. Alertness regarding:
      a. Gas leaks
      b. Fires burning too fast
      c. Choice of fuels
      d. Means of escape
      e. Procedure for sounding alarm

10. What influence does melting snow have on the air above it? How does this "ice box" effect influence the ending of winter and coming of spring?
11. How can one explain that wool is a good insulator?
12. Why does a themos bottle have a silver coating inside?
13. What is the importance of humidity control in home air-conditioning?
14. Where does the frost come from in a refrigerator?

Stress the fact that when homes are heated by an open fire, proper ventilation is necessary to:

1. Maintain an adequate content of oxygen in the air
2. Preclude excessive carbon monoxide production or concentration

Try to incorporate a review of the major understandings concerning heat into discussions of fire safety.

Develop student home projects and laboratory experiences that make functional use of the content herein and, whenever possible, involve analyses of common heat devices, such as thermometers (air, metal, and liquid), thermostats, and thermocouples.

Reference Readings

Vries, Leonard de. Book of Experiments. Macmillan, 1959.

Adler, Irving. Hot and Cold. Day, 1959.

_____. Fire in Your Life. Day, 1955.

Hogben, L. T. Wonderful World of Energy. Garden City Books, 1957.

Parker, B. M. Heat. Row, 1954.

Ruchlis, Hyman. The Wonder of Heat Energy: A Picture Story of the Vital Part Heat Plays in Our World. Harper, 1961.

Audio-Visual Materials

Films

1848	Heat, Its Nature and Transfer		11 min.
M1881	Energetically Yours	C	13 min.

Filmstrips

FsG-2131 Heat—Series 7
FsG-2142 Heat—Series 8

COURSE OUTLINE

for

Fourth
~~THIRD~~ SIX WEEKS

of

SCIENCE — LEVEL III

TALENT PRESERVATION CLASSES

Houston Independent School District
Houston, Texas
February 1965

LEVEL THREE

UNIT IV: Electricity and Machines (Approximately six weeks)

Textbooks: Davis, Ira C., John Burnett, and E. Wayne Gross. Science 3: Discovery and Progress. New York: Henry Holt & Co., 1958.

Hogg, John C., Judson B. Cross, and Kenneth E. Vordenberg. Physical Science: A Basic Course. Princeton: D. Van Nostrand Co., Inc., 1959.

TOPIC 1: Electricity

Textbook References

Physical Science: A Basic Course, pp. 393-444.

Science 3: Discovery and Progress, pp. 281-314.

.....

Content	Suggestions
A. Magnetism 1. Natural magnets a. Lodestone b. The earth 2. Artificial magnets a. Temporary magnets (soft steel) b. Permanent magnets (hard steel) 3. Magnetic substances a. Iron (steel) b. Nickel c. Cobalt 4. Magnetic field and polarity a. Lines of force b. Intensity c. Induction d. Law of magnetism	As a subject for science study, magnetism is important in two ways. First, since magnetism does not have any noticeable effect on the human body, the student is required to study it indirectly, through observation of its effects on other projects. This provides considerable ground for student experience in using indirect means to develop concrete understanding. Second, this very experience—of making an indirect study of a phenomenon—is a requisite for a successful study of electricity. Conduct class discussions and promote pupil projects on the basis of such questions as the following: 1. What parallel is there between magnetic intensity and Newton's Law of Gravitation?

5. How magnets are made
   a. Using permanent magnet
   b. Using electricity
      (1) Electromagnet
      (2) Door bell

2. What is the Domain Theory?

3. What is the relationship between geographic latitude and the dip of a compass needle? How could this be demonstrated in the laboratory?

4. What are the hand rules concerning electromagnetism?

B. Static electricity

1. Electron-proton theory

2. Law of charges

3. The electroscope

4. The condenser (Leyden jar)

5. Lightning

6. Friction as a cause of static electricity

In introducing the study of static electricity, review the following points concerning the mass and the behavior of electrons and protons:

1. The mass of a proton is about 1850 times that of an electron.

2. Static electricity is accounted for by the movement of electrons.

3. The phenomenon of "charge" is based on electron concentration. Where the electrons outnumber the protons, the charge is negative; where there are fewer electrons than protons, the charge is positive; where there are approximately equal numbers of protons and electrons, there is no charge and the state is said to be neutral.

4. Static electricity can occur only in objects that resist the flow of electrons, thereby permitting a charge to develop.

5. Electrical discharge (or electric current) always involves an electron movement from a greater to a lesser concentration of electrons. This movement is called a "spark," or "lightning," if it involves the jumping of electrons from one object to another; if it involves the passage of electrons through a conductor, it is called an electric current.

C. Current electricity

1. Direct current (D.C.)
   a. Wet cell
   b. Dry cell
   c. Storage battery

Talent Preservation students may not be able to develop much functional understanding of the mathematical applications of Ohm's Law, such as the formulas for determining total resistance in series and parallel circuits. It is suggested that the following procedures

2. Electrical circuits
   a. Series
   b. Parallel

3. Electrical measurement
   a. Volt
   b. Ampere
   c. Ohm
   d. Ohm's Law

4. Advantages of a parallel circuit in home wiring

5. Fuses and circuit-breakers

6. Alternating current (A.C.)
   a. 60 cycle (meaning)
   b. Advantages in home use

7. The electric motor

8. The electric generator
   a. Automobile generator
   b. Dynamo

9. Electrical power (Kilowatts)

10. Devices that transform electrical energy into:
    a. Light energy
    b. Heat energy
    c. Mechanical energy

D. Terms

1. Insulator

2. Conductor

3. Terminal

4. Cell

5. Battery

6. Generator

be employed as a supplement to, or substitution for, a study of the mathematical principles of Ohm's Law:

1. Encourage the students to develop home projects in the construction and analysis of electrical devices such as an electroscope and a Leyden jar.

2. Arrange for each student to have some direct experience with such devices as the wet cell, on at least two separate occasions.

3. Establish a theme of genuine inquiry in laboratory work by emphasizing two questions: "Why?" and "What would happen?" Provide for the use of actual measuring devices as indicators of possible answers.

4. Develop student skills in the arrangement of circuits on a circuit board, and in the repair of electric cords and plugs.

5. Use the voltmeter, ammeter, and ohmmeter (or known resistors) to demonstrate the relationship between electrical force, current and resistance. Urge students to extend from this in the mathematical pursuit of Ohm's Law.

6. Involve the students in projects and laboratory work that make use of electromagnets. Expand on the advantage of A.C. current for transformers and D.C. current for large electromagnets. Try to have them discover the factors that surround electromagnetic induction, such as those which provide for step-up and step-down of voltage.

Conduct discussion and promote student projects on the basis of the following questions:

1. How is chemical energy transformed into electrical energy?

2. What are "external" and "internal" circuits?

3. What is the difference between direct current and alternating current?

7. Motor
8. Volt
9. Ampere
10. Induction
11. Electromagnet
12. Magnetism
13. Circuit
14. Condenser
15. Dynamo
16. Current electricity
17. Static electricity
18. Electron
19. Proton
20. Negative charge
21. Positive charge
22. Theory
23. Intensity
24. Kilowatt
25. Fuse
26. Electric meter
27. Direct current
28. Alternating current
29. Transformer

4. How does the storage battery work? How does it differ from the wet cell?
5. How can we make a simple electric motor out of materials available in the home?
6. How do we measure the amount of electricity used in the home?
7. How is my home wired? What are the circuits? What electrical devices are on each one?
8. How do transformers work?
9. How does a generator work?
10. What precautions are necessary in using electricity?
    a. To prevent fire?
    b. To prevent electrocution?
11. How is electricity transported from its source to my house? What are the sources of electricity in the Houston area?
12. How is magnetism used in various electrical devices? What are the hand rules for magnetism?

Reference Readings

Adler, Irving. Energy and Power. Knopf, 1958.

Arnold, J. P. Exploring Electricity. McKnight, 1960.

Bitter, Francis. Magnets. Doubleday, 1959.

Dull, C. E. Modern Physics. Holt, 1955.

Dunsheath, Percy. Electricity: How It Works. Crowell, 1960.

Freeman, I. M. All About Electricity. Random House, 1957.

Kennedy, J. M. Making Electricity Work. Crowell, 1959.

Lewellen, J. B. Understanding Electronics: From Vacuum Tube to Thinking. Crowell, 1957.

Marcus, Abraham. Basic Electricity. Prentice, 1958.

Meyer, J. S. Picture Book of Electricity. Lothrop, 1953.

Morgan, A. P. Boy Electrician. Lothrop, 1948.

_____. First Electrical Book for Boys. Scribner, 1951.

_____. Things a Boy Can Do with Electricity. Scribner, 1938.

Parker, B. M. Electricity. Row, 1955.

Sootin, Harry. Experiments in Magnetism and Electricity. Watts, 1962.

Yates, R. F. Boys' Book of Magnetism. Harper, 1941.

Zarchy, Harry. Using Electronics: A Book of Things to Make. Crowell, 1958.

Garbedian, H. G. Thomas Alva Edison, Builder of Civilization. Messner, 1947.

Guthridge, Sue. Tom Edison, Boy Inventor. Bobbs, 1947.

Meadowcroft, W. H. Boy's Life of Edison. Harper, 1921.

Walters, H. B. Nikola Tesla, Giant of Electricity. Crowell, 1961.

Weir, R. C. Thomas Alva Edison, Inventor. Abingdon, 1953.

Audio-Visual Materials

Films

L2042	Story of the Modern Storage Battery		11 min.
1161	Thunder and Lightning		11 min.
M2487	Electricity: Distribution	C	16 min.
2486	Electricity: Measurement	C	12 min.
48	Electrochemistry		11 min.

1687	Electromagnets		10 min.
23	Electrostatics		11 min.
M2490	Exploring Electromagnetic Energy	C	14 min.
1652	Flow of Electricity		10 min.
2470	How to Produce Electric Current with Magnets		11 min.
338	Introduction to Electricity		11 min.
1527	Learning about Electric Current		8 min.
2471	Magnetic, Electric, and Gravitational Fields	C	11 min.
M1400	Magnetism		16 min.
M1464	Out of the Dark (Lightning)		15 min.
1291	Primary Cell (Dry cell)		10 min.
M1714	Principles of Electricity	C	20 min.
407	Series and Parallel Circuits		11 min.
2261	Simple Demonstrations with Magnetism	C	11 min.
M2485	What Is Electricity? (Production of)	C	13 min.
M1399	What Is Electricity? (Electrostatics)		14 min.
L1692	Yours to Command (Electric service)	C	20 min.

Filmstrips

Fs- 724	Electricity
FsG-2130	Electricity and Magnetism—Series 7
FsG-2141	Electricity and Magnetism—Series 8
Fs-1346	What Is Magnetism?

TOPIC 2: MACHINES

Textbook References

Physical Science: A Basic Course, pp. 312-332.

Science 3: Discovery and Progress, pp. 341-366.

.....

Content	Suggestions
A. Definition of work	Develop the following understandings concerning simple machines:
B. Definition of a machine	1. Regardless of its configuration, an object does not become a machine until it is placed in motion. The reason for this is found in the definition of a machine—that a machine is an object that works to the advantage of man.
C. Types of simple machines 1. Lever 2. Inclined plane 3. Pulley 4. Wedge 5. Screw 6. Wheel and axle	2. A simple machine is one that involves no "internal" work, wheras a compound machine is one that does involve "internal" work.
D. Basic principles of levers 1. Resistance, effort, and fulcrum 2. Three classes of levers 3. Why man uses levers a. To save force b. To save distance c. To change direction of force	3. Despite any similarity that one simple machine may have to another, its identity is established not on the basis of its configuration, but on the manner in which it affects work. Configurations tend only to indicate the usual and most effective devices by which such manner of work may be done.
4. Factors involved (disregarding friction) a. Work b. Work input and output	Discuss and demonstrate work problems involving at least three known factors and one unknown factor. Show the students how to divide the solution of a problem into two separate stages,

c. Mechanical advantage
d. Efficiency (100% if friction disregarded)
e. Measurements of power

E. Basic principles and factors of the inclined plane

F. Basic principles and factors of pulley systems

1. Fixed pulley

2. Movable pulley

G. Compound machines

1. Applications of simple machines

2. Friction
   a. Effect on efficiency
   b. Use of lubricants
      (1) Water
      (2) Grease
      (3) Oil
      (4) Graphite
   c. Use of bearings
      (1) Metal
      (2) Jewel (movements)

3. Transmission of force
   a. Belts, ropes, chains
   b. Gears
   c. Hydraulics
   d. Pneumatics

4. Energy transformations in common compound machines

as follows:

1. Identifying the situation and placing the values of each factor into proportion

2. Solving the unknown factor in the proportion

Develop the idea of a proportion being two equal ratios. A work situation may thus be placed into proportion as follows:

$$\frac{W}{D} = \frac{F}{1}$$ where W = Work, D = Distance, F = Force

No matter what work problem is under consideration, the solution can always be based on this proportion. For example, in the above proportion, W times 1 equals F times D; hence $W = \frac{F \times D}{1}$, $F = \frac{W \times 1}{D}$, $D = \frac{W \times 1}{F}$, and

$$1 = \frac{D \times F}{W}$$

The student does not have to memorize all the above formulas, since they appear as automatic computations in the process of solving the proportion.

Collaborate on this part of the work with the students' mathematics teachers. Such cooperation can do much to strengthen the students' understanding of the role of mathematics as the language of science.

Make frequent use of laboratory materials for introducing the principles of the various machines and demonstrating certain work problem situations. Some of the students may be able to explore work problem situations regarding the wedge, the screw, and the wheel and axle. If so, have them demonstrate and explain their work to the rest of the class.

Explain that friction is a third force that acts externally upon a simple machine, in addition to resistance and effort. Explain how it varies directly with the ratio of output to input, and thereby affects the efficiency of a machine.

Proportions Applicable in Problem Situations

1. Work (See previous page)

2. Input-output where

$$\frac{R}{E} = \frac{D^e}{D^r}$$

R = Resistance
E = Effort
D^e = Effort distance
D^r = Resistance distance

Mechanical advantage where

$$\frac{M.A.}{1} = \frac{R}{E} = \frac{D^e}{D^r}$$

M.A. = Mechanical advantage

4. Efficiency where

$$\frac{Eff}{1} = \frac{R \times D^r}{E \times D^e}$$

Eff = Efficiency

5. Horsepower

$$\frac{H.P.}{1} = \frac{R \times D^r}{t \times 550}$$

where H.P. = Horsepower
t = Time in seconds
550 is a constant

Reference Readings

Adler, Irving. Energy and Power. Knopf, 1958.

Barrow, George. Your World in Motion: The Story of Energy. Harcourt, 1956.

Beumphrey, Geoffrey. Engines and How They Work. Watts, 1960.

Buehr, Walter. The Story of the Wheel. Putnam, 1960.

Burlingame, Roger. Machines that Built America. Harcourt, 1953.

De Camp, L. S. Man and Power: The Story of Power from the Pyramids to the Atomic Age. Golden, 1961.

Dull, C. E. Modern Physics. Holt, 1955.

Elting, Mary. Machines at Work. Garden City Books, 1953.

Hartman, Gertrude. Machines and Men Who Made the World of Industry. Macmillan, 1939.

Huey, E. G. What Makes the Wheels Go Round: A First-Time Physics. Harcourt, 1952.

Mann, Martin. How Things Work. Crowell, 1960.

Marcus, Abraham. Power Unlimited: The Story of Power from Windmill to Nuclear Energy. Prentice, 1959.

Meyer, J. S. Machines. World, 1958.

Peet, Creighton. How Things Work: Story and Pictures. Holt, 1941.

Schneider, Herman. Everyday Machines and How They Work. McGraw, 1950.

Sharp, E. N. Simple Machines and How They Work. Random House, 1959.

Sutton, Felix. Big Treasure Book of Wheels: 70 Things That Move on Wheels. Gresset, 1953.

Audio-Visual Materials

Films

1651	Machines Do Work.		11 min.
103	Simple Machines		11 min.
1692	Transmission of Rotary Motion		11 min.
2001	We Use Power.	C	11 min.
1453	Friction.		11 min.

Filmstrips

Fs-2025 Introducing Inclined Planes

Fs-2024 Introducing Levers

Fs-2027 Invitation to Science (1958) (Use of machines)

COURSE OUTLINE

for

FIFTH SIX WEEKS

of

SCIENCE—LEVEL III

TALENT PRESERVATION CLASSES

Houston Independent School District
Houston, Texas
April 1965

LEVEL THREE

UNIT V: CONSUMER SCIENCE—PHYSICAL (Approximately six weeks)

Textbooks: Davis, Ira C., John Burnett, and E. Wayne Gross. Science 3: Discovery and Progress. New York: Henry Holt & Co., 1958.

Hogg, John C., Judson B. Cross, and Kenneth E. Vordenberg. Physical Science: A Basic Course. Princeton: D. Van Nostrand Co., Inc., 1959.

TOPIC 1: COMMUNICATIONS

Textbook References

Physical Science: A Basic Course, pp. 506-528.

Science 3: Discovery and Progress, pp. 317-338.

.....

Content	Suggestions
A. The telegraph B. The telephone 1. Transmitter 2. Receiver C. The radio 1. Radio waves 2. Transmitter—AM, FM 3. Receiver D. Television 1. The camera and transmitter 2. The receiver E. Special communications 1. Radar	The main purpose of this unit is to provide a general review of the preceding four units in Level Three. This review is valuable as a means of developing major understandings for students who were absent during the regular coverage, and may also be used to emphasize the applications of scientific skills and understandings from the standpoint of the consumer. Use the content of this particular Topic as an area for reviewing the major understandings concerning magnetism and electricity, especially those of the energy transformations that exist in communication systems. Sponsor student projects in pursuit of such questions as: 1. What are the advantages of AM and FM radio systems? 2. What part does the telephone company play in getting television to the home? What facilities do they have for this?

2. Use of satellites

3. Reserved frequencies for:
   a. Police and other services
   b. Aircraft and marine vessels
   c. Private (ham) operators

3. How does a crystal radio work?

4. How does a transistor work?

5. Who developed the first telephone and what electronic principles did he introduce?

6. How can one become a "ham" radio operator?

Reference Readings

Bendick, Jeanne. Television Works Like This. McGraw-Hill, 1954.

Bertin, L. The Boy's Book of Radio, Television and Radar. Roy, 1957.

Fink, Donald. The Physics of Television. Doubleday, 1959.

Floherty, J. J. Television Story. Lippincott, 1951.

Gould, Jack. All About Radio and Television. Random House, 1953.

Meyer, J. L. Picture Book of Radio and Television and How They Work. Lothrop, 1951.

Morgan, A. P. Boy's First Book of Radio and Electronics. Scribner, 1954.

Shippen, K. B. Mr. Bell Invents the Telephone. Random House, 1952.

Stevenson, O. J. Talking Wire; the Story of Alexander Graham Bell. Messner, 1947.

Yates, R. F. Boy's Book of Communications. Harper, 1942.

Audio-Visual Materials

Films:

406	Sound Recording and Reproduction	11 min.
L1352	Mr. Bell	32 min.
1902	The Story of Motion Pictures	6 min.

Filmstrip:

Fs-954 Samuel F. Morse

Tapes:

T107	Alexander Graham Bell	15 min.
T 97	Conquerors of Sight, Sound and Space—Forerunners of Television	15 min.

LEVEL THREE

UNIT V: CONSUMER SCIENCE—PHYSICAL (Approximately six weeks)

Textbooks: Davis, Ira C., John Burnett, and E. Wayne Gross. Science 3: Discovery and Progress. New York: Henry Holt & Co., 1958.

Hogg, John C., Judson B. Cross, and Kenneth E. Vordenberg. Physical Science: A Basic Course. Princeton: D. Van Nostrand Co., Inc., 1959.

TOPIC 2: REVIEW OF PHYSICAL SCIENCE

Textbook References

(Refer to the pages listed at the beginning of each unit)

.....

Content	Suggestions
Review of Level Three Units A. UNIT I: Matter on Earth B. UNIT II: Energy and the Human Body C. UNIT III: Heat D. UNIT IV: Electricity and Machines	Sponsor pupil projects and class discussions that will help the students recognize applications of the content to their own positions, either as direct consumers or as ones who are identified with direct consumers. Encourage the students to participate in the following activities: 1. Collecting and organizing pictures and clippings of materials that relate to the review 2. Constructing models of various devices that relate to the review 3. Making posters that reflect the main understandings to be drawn from the review 4. Writing short, original papers that reflect the applications of the content to the consumer 5. Analyzing and repairing devices that relate to the review

Develop a simple form upon which you can record the students' strengths and weaknesses as each topic is reviewed. The information that can be gained through such an evaluation would help to indicate pupil achievement, and would be helpful in planning for subsequent classes. It is suggested that such an evaluation, made regularly and consistently, include the following objectives:

1. Ability to:
   a. Reflect understanding
   b. Demonstrate skills acquired from the course
   c. Generalize
   d. Realize applications
   e. Transfer training

2. Motivation
   a. Shows interest
   b. Volunteers information
   c. Asks pertinent questions
   d. Shows readiness to do activities
   e. Applies reviewed material in other classes

Emphasize the following points in this review:

1. Motions of the earth

2. Forms and transformations of energy

3. Atomic and molecular nature of matter

4. Water cycle

5. Fire safety

In class discussions, try to incorporate these points with the various applications of content, as they become realized by the students.

LEVEL THREE

(Sixth Six Weeks)

UNIT VI: CONSUMER SCIENCE—BIOLOGICAL AND EARTH (Approx. six weeks)

Textbook References

In addition to the pages listed at the beginning of each unit in the Level Three Course of Study, refer to the appropriate chapters in Level Two textbooks as well.

.....

Content	Suggestions
Review of Level Three Units	As in Unit V, the emphasis here should be on:
A. UNIT I: Animal Life	1. Main understandings
B. UNIT II: The Human Body	2. Applications as viewed from the position of the consumer
C. UNIT III: Plant Life	3. Skills and procedures relating to the science curriculum
D. UNIT IV: Air and Space	
E. UNIT V: The Changing Earth	Most of the activities that were effective in the review of physical science will also be effective in the review of biological and earth science. Scientific patterns of behavior will become more evident as the problem of factual recall becomes more serious in reviewing material a year later.
	The successes and failures that will be indicated through evaluation constitute a sound basis upon which planning can be done for the next school year. Let this particular course be a stepping stone toward strengthening the curriculum in relation to your own personality and unique teaching methods. Remember that no Talent Preservation student is going to master all of the content, and that the main purpose of this course is to set the pupils into academic motion, to help them acquire the skills and understandings that are essential for a self-realizing individual in modern society.

COURSE OUTLINE

for

SECOND SIX WEEKS

of

SCIENCE - LEVEL II

TALENT PRESERVATION CLASSES

Houston Independent School District

Houston, Texas

October 1964

LEVEL TWO

UNIT II. THE HUMAN BODY (Approximately six weeks)

TOPIC 1: BODY SYSTEMS

Textbook References

Living Things, pp. 186-267; expanded reading, pp. 112-114.
Adventures in Science, pp. 238-277.
Science 2, pp. 310-345.

. . . . . .

Content	Suggestions
A. Skeletal system 1. Kinds of skeletons a. Exoskeleton b. Endoskeleton 2. Tissues (Cellular nature) a. Cartilage b. Bone c. Ligament 3. Skeletal subsystems a. Axial skeleton (1) Skull (2) Spinal column b. Appendicular skeleton (1) Paired limbs (2) Pectoral girdle (3) Pelvic girdle 4. Main bones 5. Skeletal functions a. Support—appendages, girdles b. Production of red blood cells c. Containment—skull, spinal column	Encourage students to bring in old bones for examination. Guide the students in discussions and projects concerning the human skeleton, with questions such as: 1. What are the parts of a bone? What is the periosteum? What is bone marrow? 2. How does calcification take place? 3. How does the pectoral girdle support the forelimbs? Is this different from the way the pelvic girdle supports the hind limbs? 4. What can one do with his arms that he cannot do with his legs? Why? 5. Why do higher animals require a good axial skeleton? 6. What does the word "axial" mean? What is meant by bilateral symmetry? What human bones are not in pairs? 7. How do bones produce red blood cells? 8. What foods are good for building bones? 9. What do ligaments do? What are joints? 10. How do bone structures relate to their functions?

6. Damage to the skeletal system
    a. Sprains and dislocations
    b. Fractures
        (1) Simple
        (2) Displaced
        (3) Compound

B. Muscular system
    1. Kinds of muscles
        a. Voluntary muscle
        b. Involuntary muscle
        c. Heart muscle
    2. Connective tissue
        a. Muscle sheaths
        b. Tendons
    3. Work (Force x Distance)
    4. Muscular functions
        a. Work of voluntary muscles
        b. Work of involuntary muscles
        c. Work of heart muscle
    5. Damage to the muscular system
        a. Strains and bruises
        b. Torn muscles and tendons
        c. Muscle diseases
            (1) Muscular dystrophy
            (2) Trichinosis

C. Digestive system
    1. Classes of foods
        a. Carbohydrates
        b. Proteins
        c. Fats
    2. Meaning of digestion
    3. The digestive tract
        a. Mouth
        b. Esophagus
        c. Stomach
        d. Pylorus
        e. Small intestine
            (1) Bile duct, gall bladder
            (2) Pancreatic duct
            (3) Villi
        f. Large intestine

Correlate the content of the two topics of this unit whenever possible; that is, stress the various aspects of disease, health, and safety as outlined in Topic 2 whenever they can be shown to apply in specific instances during the study of body systems in Topic 1. If you follow this plan you will want to spend most of the six-week period on Topic 1, with the content from Topic 2 brought in as supplementary material.

List all the body systems on the chalkboard and discuss them briefly at the beginning of this unit. This will give the students an opportunity to begin work on projects involving all of the body systems, and thereby spread the positions of authority.

Guide the study of muscles with such questions as:

1. Where in the body are involuntary muscles used? What is peristalsis?
2. How do muscles relate to the seven life functions of the human body?
3. Why do muscles have to rest? How are the seven life functions involved in a muscle cell?
4. What is the story of the trichina worm?
5. How do muscles bring about work? What is work?
6. Is there any truth to the saying that the more you exercise, the more muscle you gain? Why?
7. Why are there relatively long tendons, such as those that work the fingers?

Discuss the classes of foods as you begin the study of digestion, and leave the student with the understanding that because of chemical differences, each class of food requires specific body enzymes, acids, or bile to help prepare it for assimilation. Dwell at length on the need for digestion.

Expand on the ways in which man pre-digests his food, such as in cooking and mastication by teeth.

4. Enzymes (Specific for classes of food)
5. Stomach acid
6. Bile (to emulsify fat)
7. Digestive function—to prepare food for absorption
8. Damage to the digestive process
   a. Poor eating habits
      (1) Not eating regularly
      (2) Eating too fast
   b. Poor selection of daily menu—unbalanced diet
   c. Undercooking and overcooking
   d. Poor mastication
      (1) Swallowing whole
      (2) Poor teeth
   e. Ulcers
   f. Being distracted while eating—arguments, tenseness
   g. Eating spoiled food and indigestible matter
9. Vitamins and minerals
10. Calories
    a. Energy value of foods
    b. Daily requirements

D. Circulatory system
   1. Arteries, veins, and capillaries
   2. Heart
   3. Blood movement
      a. Movement to and from heart
      b. Blood pressure
   4. The blood
      a. Red blood cells
      b. White blood cells
      c. Plasma and hemoglobin

Emphasize how enzymes are produced by duct glands and how the digestive tract is actually a canal into which these ducts deposit their respective juices.

Explain how muscular action in the digestive tract is involuntary.

Guide the study of digestion with such questions as:

1. Why does man need a pylorus? Intestines?
2. What is appendicitis?
3. What is the importance of solubility in the process of digestion?
4. Why is bile not an enzyme?
5. Where is digested food absorbed into the body? Where is water absorbed?
6. How do the teeth aid digestion? How does cooking help?
7. Which of the seven life functions is (are) implicated in the digestive system?
8. How many organs are in the digestive system? What is the function of each one?
9. What is a well-balanced diet? What would be a good week's menu?

Throughout the study of this topic, stress how each body system is made up of organs, and how the function of the system is the result of the combined specific organ functions. Try to guide such discussions to a consideration of the idea of division of labor, even in tissues and cells. Refer to the human body as being an empire consisting of over twenty-five trillion units of life—cells—and that the degree of organization indicates the degree of health that exists.

Guide the study of circulation with such questions as:

1. How does the circulatory system compare with a garbage collector? What is the comparison between houses and cells? Where is the dump?
2. Why is it more serious to cut an artery than a vein?
3. What is the comparison between the functions of arteries and veins?
4. How do white blood cells help fight disease?

5. Functions of blood

   a. Carrying food
   b. Carrying wastes
   c. Carrying oxygen
   d. Carrying hormones
   e. Fighting disease
   f. Helping to regulate body temperature

6. Pressure points

7. Damage to the circulatory system

   a. Cuts and bruises
   b. Blood clots
   c. Tight-fitting clothes
   d. Hardening of the arteries
   e. Over-indulgence
      (1) Food
      (2) Alcohol
   f. Insufficient rest

5. How does blood pick up oxygen at the lungs? What does it release there?

Describe how yawning is the body's natural procedure for getting blood to the heart when one sits relaxed for long periods of time, or when one gets up in the morning. Explain how venous blood depends on body movement (pressure by muscles) to force it back to the heart. Contrast this with the muscular arteries, pulse, and blood pressure. Explain how blood pressure becomes reduced as blood passes through the capillaries. Discuss the function of the cup-shaped valves in the veins.

E. Endocrine system

   1. Ductless glands
   2. Hormones
   3. Endocrine glands

      a. Thyroid
      b. Adrenal
      c. Pancreas
      d. Pituitary
      e. Sex organs

Compare the ductless glands with the duct glands of the digestive system, such as the salivary glands. Point out how the ductless glands secrete directly into the blood stream.

Discuss how—upon maturation—the sex organs produce hormones that influence the development of secondary sex characteristics, such as voice (androgens by males; estrogens by females).

Stress the importance of the endocrine system in such functions as regulating body growth and preparing the body for emergencies (adrenalin).

F. Excretory system

   1. Kidneys
   2. Sweat glands
   3. Liver (bile)
   4. Lungs
   5. Excretory function—to get rid of waste material

Explain how each cell produces waste material and how the excretory organs operate to free the body of such wastes.

Discuss the part that sweat glands play in both excretion and regulation of body temperature. Stress the need for frequent bathing to remove the waste materials deposited by the sweat glands on the skin.

Describe how the lungs function to release carbon dioxide from the body, how the liver functions to eliminate wornout blood cells, and how the kidneys function as organs for filtering out urea.

G. Nervous system

1. The nerve cell
2. Voluntary control
3. Involuntary control
4. Impulses
   a. Sensory
   b. Motor
5. Brain and spinal cord
   a. Cerebrum
   b. Cerebellum
   c. Medulla
   d. Spinal cord
6. Reflexes
7. Sense organs
8. Memory, thinking, reasoning
9. Habits
10. Mental disorders
    a. Inhibitions
    b. Neuroses
    c. Psychoses

Expand on the following ideas concerning the human nervous system:

1. Impulses pass from cell to cell.
2. Safety and health are to a large extent the result of habits formed through development of the nervous system.
3. Sensory impulses reflect the impact of the external environment against the body. They also reflect the needs of the internal organs.
4. Motor impulses reflect the mental decision to act against environment. They also function in the involuntary control of body organs.
5. Nervous system functions include coordination and control.
6. The spinal cord takes care of many responses through reflex action.
7. Voluntary responses are taken care of in the cerebrum—which is the seat of consciousness.
8. Nervous behavior is the result of long years of growth and development.
9. Mental illness often occurs in relation to social change.

H. Respiratory system

1. Composition of air
2. Trachea and bronchial tubes
3. The nose—a filter system
4. Lungs
   a. Air sacs
   b. Blood supply
      (1) Pulmonary artery
      (2) Pulmonary vein
5. How blood carries oxygen
6. Proper ventilation
7. Artificial respiration
8. Atmospheric pressure and the lungs
   a. Inhalation
   b. Exhalation
9. Artificial lung
10. Hazards of smoking

Guide the study of the respiratory system by discussing such matters as:

1. All living things carry on respiration as a means of releasing energy.
2. There is some chemical similarity between respiration (slow oxidation) and fire (rapid oxidation).
3. Houses must be properly ventilated in both summer and winter.
4. Most air conditioners do not bring in fresh air.
5. Sufficient oxygen for good rest and health is assured by frequent ventilation.
6. Man's breathing is dependent on atmospheric pressure.
7. Everyone should know how to administer mouth-to-mouth respiration.
8. One should not cough in another's face.

Reference Readings

Asimov, Isaac. Chemicals of Life: Enzymes, Vitamins, Hormones. Abelard, 1954.

Baitsell, G. A. Human Biology. McGraw, 1950.

Baruch, D. W. My Body and How It Works. Harper, 1934.

Clark. You and How the World Began. Children's Press, 1957.

Cosgrove, Margaret. Wonders Inside You. Dodd, 1955.

Evans, E. K. Why We Live Where We Live. Little, 1953.

Glemser, Bernard. All About the Human Body. Random, 1958.

Kreeber, Elsbeth. Biology. Heath, 1957.

Lent, H. B. Man Alive in Outer Space. Macmillan, 1961.

Lyttleton, Elizabeth. You Yourself. Putnam, 1959.

Mead, Margaret. People and Places. World, 1959.

Moon, T. J. Modern Biology. Holt, 1921.

Parker, B. M. How We Are Built. Row, 1955.

Ravielli, Anthony. Wonders of the Human Body. Viking, 1954.

Reid, D. M. Introduction to Biology. Cambridge University Press, 1962.

Riedman, S. R. Food for People. Abelard, 1954.

Scheele, W. E. Prehistoric Man and the Primates. World, 1957.

Schneider, Herman. How Your Body Works. Scott, 1949.

Schneider, Lee. Lifeline: The Story of Your Circulatory System. Harcourt, 1958.

_____. You and Your Senses. Harcourt, 1956.

Selsam, M. E. Plants We Eat. Morrow, 1955.

Turnbull, C. M. The Peoples of Africa. World, 1962.

Weart, E. L. The Story of Your Blood. Coward, 1960.

_____. The Story of Your Brain and Nerves. Coward, 1961.

_____. The Story of Your Glands. Coward, 1963.

Wells, Harington. General Biology. McGraw, 1956.

White, A. T. First Men in the World. Random House, 1953.

Wilson, Mitchell. The Human Body: What It Is and How It Works. Golden, 1959.

Zim, H. S. Our Senses and How They Work. Morrow, 1956.

Audio-Visual Materials

Films

1045	Food That Builds Good Health	10 min.
169	Foods and Nutrition	11 min.
188	Fundamentals of Diet	11 min.
M 1393	Understanding Vitamins	14 min.
M 2021	Your Body Speaks (Posture)	12 min.
L 1908	The Alphabet Conspiracy: Part I	C 30 min.
L 1909	The Alphabet Conspiracy: Part II	C 30 min.
M 1380	Circulation	C 18 min.
166	Control of Body Temperature	11 min.
L 2441	Exploring the Human Nervous System	C 23 min.
1932	Exploring Your Growth	11 min.
M 1986	Fundamentals of the Nervous System	16 min.
L 1937	Gateways to the Mind: Part I	C 30 min.
L 1938	Gateways to the Mind: Part II	C 30 min.
L 1672	Hemo, the Magnificent: Part I	C 30 min.
L 1673	Hemo, the Magnificent: Part II	C 30 min.
M 1949	The Human Body: Circulatory System	C 13 min.
M 2104	The Human Body: Digestive System	C 13 min.
M 2295	The Human Body: Muscular System	C 13 min.
M 1927	The Human Body: Nervous System	C 13 min.
M 2296	The Human Body: Nutrition and Metabolism	C 13 min.
M 2294	The Human Body: Respiratory System	C 13 min.
1689	The Human Body Skeleton	11 min.
M 1542	The Human Machine	14 min.
336	Human Skin	12 min.
1842	Mechanics of Breathing	11 min.
1076	Miracle of Life	10 min.
M 2306	Principles of Endocrine Activity	C 16 min.
1866	The Skeleton	12 min.
M 2308	Tissues of the Human Body	C 17 min.
L 2151	The Thread of Life: Part I	C 30 min.
L 2152	The Thread of Life: Part II	C 30 min.
M 2135	Wonder of Our Body	C 12 min.
M 1878	Work of the Blood	13 min.

Filmstrips

Fs-1363	The Bones and Muscles
Fs- 699	Care of the Feet
Fs-1362	The Circulatory System
Fs-1352	Control of Body Temperature
Fs-1364	The Digestive System
Fs-1354	Endocrine Glands
Fs- 703	Heart and Circulation
Fs-1977	How Food Is Digested
Fs-1351	Mechanics of Breathing
Fs-1353	The Nervous System (Structure and Functions)
Fs-1360	The Nervous System (Voluntary—Involuntary)
Fs- 704	Reproduction Among Mammals
Fs-1359	The Respiratory System
Fs-1361	The Skin, Hair, and Nails
Fs-1941	You, the Human Being
Fs-1492	You and Your Five Senses
Fs-1945	Your Senses of Smell and Taste
Fs-1946	Your Sense of Touch
Fs-1948	You, the Living Machine
Fs-1366	How Vitamins Help Man
Fs- 702	Foods and Nutrition
Fs-1947	You and Your Food
Fs- 924	Man of Long Ago
Fs- 714	Food from the Sun

Transparencies

Tr-1003	Skeletons of Man and Frog
Tr-1010	The Endocrine Glands
Tr-1007	Human Body Tissues
Tr-1002	Human Circulatory System
Tr-1009	The Human Digestive System
Tr-1004	Human Mouth and Nasal Cavities
Tr-1005	Human Muscular System
Tr-1015	The Human Skeleton
Tr-1006	Human Teeth
Tr-1014	Human Thoracic and Abdominal Cavities
Tr-1038	Mitotic Cell Division
Tr-1008	The Simple Nervous Arc
Tr-1011	Structure of the Human Heart

TOPIC 2: HEALTH AND SAFETY

Textbook References

Living Things, pp. 225-227, 268-307; expanded reading, pp. 243-245, 336-355.

Science 2, pp. 346-414.

. . . . . .

Content

A. The meaning of disease

B. Types of disease
   1. Infectious disease
   2. Deficiency disease
   3. Organic disease
   4. Allergy
   5. Intoxication

C. Acquiring disease
   1. By living agents
      a. Bacteria
         (1) Bacilli
         (2) Cocci
         (3) Spirilla
      b. Fungi that cause:
         (1) Ringworm
         (2) Athlete's foot
      c. Protozoa (Malaria)
      d. Worms
         (1) Flatworms
         (2) Roundworms
      e. Stinging, biting, and sucking insects, and spiders
      f. Viruses
      g. Pollen
   2. By nonliving agents
      a. Physical
         (1) Mechanical
         (2) Heat, light, electricity
      b. Chemical
         (1) Deficiencies
         (2) Poisons

Suggestions

Since Level Two students may drop out of school during this school year, it is imperative that basic understandings concerning the nature of disease be emphasized. Arrange for the school nurse and others with medical background to come in for discussions.

In the discussions concerning the various diseases, show how each prevents the normal function of certain tissues or organs and thus affects whole systems and the body itself. Develop the understanding that good health is a situation in which all of the body systems are functioning at optimum performance.

Point out that cleanliness is not only basic to good health, but essential for social acceptance and leadership.

Encourage the development of student projects that explore current health problems. Start a file of newspaper and magazine clippings on current health problems. Coordinate such activities with the projects of other Talent Preservation teachers.

Develop the understanding that poor health is the result of some very real causes, and that its correction must involve equally real cures.

Point out that one can lessen his dependence on others regarding matters of health by extending his own insight through continued formal education.

D. Transmission of disease

1. Direct personal contact
2. Indirect contact
3. Human carriers
4. Insect carriers

E. Defense against disease

1. Natural immunity
2. Acquired immunity
   a. Active
   b. Passive
3. Cleanliness
   a. Around the home
   b. In body care

F. Important terms

Inoculation
Vaccination
Immunity
Carrier
Infection
Pathology
Toxin
Medicine
Symptom
Contagious
Quarantine
Parasite
Deficiency
Communicable
Serum
Allergy
Hereditary
External disease
Internal disease

G. First aid

1. Severe bleeding
2. When breathing stops
3. Victims of poison
4. Shock
5. Fractures

Guide further discussions and projects through the use of such questions as:

1. Why are non-green plants (fungi) more often involved in human disease than green plants?
2. What does a doctor mean when he says that he does not cure disease, he only assists nature?
3. What role in disease is played by such people as "Typhoid Mary"?
4. What are some common hereditary diseases?
5. What are some common communicable diseases?
6. What is the relationship between pollen and allergy? What local plants are associated with allergy? What are the critical times of year?
7. Against which diseases should everyone be vaccinated?
8. How can infection be prevented?
9. What steps should be taken at home to prevent disease? What should the medicine chest contain? Why?
10. What are the symptoms of common diseases?
11. What medicines are used for common diseases?

Explain to the students why bleeding should be controlled by direct pressure over the wound area, and tourniquets should seldom be used, although they may be used for severe hemorrhage that cannot be controlled by other means.

Symptoms of shock:
Eyes vacant and lack luster
Pupils dilated
Breathing shallow and irregular
Pulse weak or absent
Skin pale, cold, and moist
Nausea

H. First aid terms

Hemorrhage
Artificial respiration
Pressure points
Emitic (for poisons)
Shock
Fracture

I. Common causes of accidents

1. In school
2. Beyond school

J. Factors involved in accidents

1. Anger
2. Fatigue
3. Not being alert

K. Prevention of accidents

1. Knowledge of consequence
2. Formation of correct habits
3. Obedience to rules
4. Personal code of safety

Treatment of shock:
Keep lying flat (feet up unless other factors make it inadvisable)
Maintain body temperature (blankets)
Care for underlying injuries

For any unconscious patient:
Check for adequate breathing. Restore respiration if necessary.
Try to determine cause of unconscious state.
Keep all parts of the body immobile.
Obtain professional help.

For further information concerning first aid, refer to:

1. The school nurse and other medical personnel
2. The American National Red Cross. First Aid Textbook. Washington, D.C.

Reference Readings

Coy, Harold. Doctors and What They Can Do. Watts, 1956.
Hyde, Margaret O. Medicine in Action. McGraw-Hill, 1956.
Neal, Harry E. Disease Detectives. Messner, 1959.
Ducas, Dorothy. Modern Nursing. Walck, 1962.
Starrett, Robert S. Find a Career in Medicine. Putnam's Sons, 1960.
Calder, Ritchie, The Wonderful World of Medicine. Garden City, 1958.
Eberle, Irmengarde. Modern Medical Discoveries. Crowell, 1958.
Ravielli, Anthony. Wonders of the Human Body. Viking, 1958.
Charters, W. W. A Sound Body. Macmillan, 1955.
Tharpe, Rayford W. Your Teeth: Their Importance and Care, Laidlaw, 1950.
Bogert, Jean L. Nutrition and Physical Fitness. Saunders, 1958.
Otto, James H. Modern Health. Holt, 1959.
Crisp, Katherine B. Health for You. Lippincott, 1954.
Diehl, Harold S. Health and Safety for You. McGraw, 1961.

Williams, Jesse F. Healthful Living. Macmillan, 1957.
Styler, Herman. Plague Fighters. Chilton, 1960.
Burke, Betsy. The Life You Save. McKay, 1962.
Glenn, Harold T. Safe Living. Bennett, 1960.
Botton, William. What To Do Until the Doctor Comes. Reely & Lee, 1953.
Martin, Lealon E. Conquest of Disease. Coward, 1961.
Williams, Greer. Virus Hunters. Knopf, 1959.

Audio-Visual Materials

Films

1870	How Our Bodies Fight Disease	8 min.
M 1145	From One Cell	15 min.
M 2314	World of Micro-Life	C 13 min.
M 458	Alcohol and the Human Body	14 min.
2012	Alcohol Is Dynamite	10 min.
M 793	The Brain Is the Reason (Safety)	10 min.
M 1140	Drug Addiction (Subject to the principal's authorization)	22 min.
M 1090	The Story of a Teen Age Drug Addict (Subject to the principal's authorization)	22 min.
M 2394	Is Smoking Worth It?	C 10 min.
2013	No Smoking	10 min.
1959	The Case of the Missing Tooth	C 5 min.
454	Dental Health: How and Why	10 min.
M 1606	Gateway to Health (Dental)	C 20 min.
M 495	It's Your Health (Mouth)	18 min.
M 2103	Laurie Learns a Secret (Dental)	C 20 min.
1173	Swab Your Choppers	C 7 min.
M 1607	Thirty-Two of Her Own	C 25 min.
M 1390	Antibiotics	14 min.
10	Body Defense Against Disease	11 min.
1702	First Aid on the Spot	11 min.
1870	How Our Bodies Fight Disease	8 min.
1608	How To Catch a Cold	C 10 min.
337	Immunization	11 min.

Films, contd.

1867	Obesity	11 min.
1500	Sneezes and Sniffles	10 min.
1313	Tuberculosis	11 min.

Filmstrips

Fs-1198	Alcohol and You: Part I
Fs-1199	Alcohol and You: Part II
Fs-1365	Danger of Narcotics
Fs-1200	Narcotics and You: Part I
Fs-1201	Narcotics and You: Part II
Fs- 705	Teeth (Human body)
Fs-1356	The Teeth
Fs- 87	Florence Nightingale
Fs- 659	Bacteria, Good and Bad
Fs- 698	Body Defenses Against Disease
Fs-1369	Body Defenses Against Invasion by Disease
Fs- 86	Robert Koch (Bacteriology)
Fs- 82	Madame Curie and the Story of Radium
Fs- 83	Edward L. Trudeau
Fs- 627	You and Your Food (Good health)
Fs- 699	Care of the Feet
Fs-1372	Fighting Cancer
Fs-1368	The Germ Invaders
FsG-2135	Health and Safety: Series 7
FsG-2146	Health and Safety: Series 8
Fs-1370	Helping the Body Defense Against Disease
Fs-1371	How Chemicals and Anti-biotics Fight Disease
Fs- 658	Insects, Pests, and Disease
Fs-1367	Invasion by Disease
Fs- 85	Edward Jenner and the Story of Smallpox Vaccination
Fs-1102	Our Nation's Health
Fs- 628	Pesky, the Cold Bug
Fs-1073	Pasteur
Fs- 629	Your Posture, Good or Bad

Transparencies

Tr 1037 The Malarial Parasite

Tapes

T 257 Good Nutrition and Good Health. . . . . 15 min.

T 256 Rest, Sleep Are Very Necessary for Healthful Living. . . . . 15 min.

T 258 Why Do We Get Sick? . . . . . 15 min.

Consult the latest Audio-Visual Materials Catalog for descriptions and other listings.